DETAILED ACTION

Claim Rejections - 35 USC § 112

1. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. Claim 20 is rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. Claim 20 recites a radius r that is at least 1/2 of the radius R. Although the specification indicates a range of 1 to1/4 for the radius r, it does not offer any example, teaching, or embodiment for specifying a radius of at least 1/2. Therefore, the specification lacks the proper support for the further limitation of the radius to be narrowed down to at least 1/2. If the Examiner has erred in this, please point to the page and line number where support can be found in the disclosure.

4. Claims 11-12 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claims 11-12 depend on cancelled claim 3. It is unclear what is being further limited. Therefore, claims 11 and 12 will be interpreted as being depending on claim 1.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

7. Claims 1-2, 5, 7,10, 12-13, 15, and 18-19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Honma et al. (JP Abstract 2001-002430) in view of Chenoweth (6,044,667), Sato (JP 56-31188), Richards (5,364,426), Koontz (3,997,316), and Machlan (3,806,621). Honma et al. disclose a process for producing a quartz glass crucible for pulling up a single crystal silicon comprising forming a body 14 having a crucible shape, arc melting the formed body while rotating to obtain a quartz crucible, mechanically grinding the inner surface of the crucible and then remelting the inner

surface by arc melting so as to reform the surface and eliminate residual air bubbles. Honma et al. fail to disclose specifics on the arc discharging electrodes used. Chenoweth teaches the use of several electrodes positioned around a rotational axis for the melting of glass, in which the neighboring electrodes are positioned at regular intervals from each other in a ring-like configuration forming a stable ring-like arc between the neighboring electrodes and without generating a continuous arc between electrodes facing each other across a central portion of the ring-like configuration (Figure 1A col. 4 lines 45-48). Furthermore, Chenoweth teaches positioning the electrodes so to have an absolute value of a phase difference of 120° (see path of heating current connecting three electrodes (360° divide by 3 = 120°), Figure 3, col. 6 lines 54-57) and forming a circle with a radius that is about 1/3 of the radius of an open portion of the crucible with a diameter greater than 28 inches. Such an electrode arrangement allows for the controlled placement of the hot spot of the arc discharge within the crucible (col. 4 lines 48-50, col. 7 lines 23-25). It would have been obvious to one of ordinary skill in the art at the time the invention was made to utilize the electrode arrangement of Chenoweth in the process of Honma et al. in order to control a high temperature arc discharge to a large diameter crucible for even heating.

8. Regarding the electrode structure, Honma does not specifically recite an electrode structure with 3n electrodes with 3 phase AC, 2n electrodes with 2 phase AC, or 8 electrodes with 4 phase AC. Chenoweth teaches using more or less electrodes in other configurations (col. 9 lines 19-20) and that other electrode configurations is an result effective variable that one skill in the art could arrive at by routine

experimentations (col. 10 lines 15-21). Sato teaches creating ring like arc with multiple electrodes with multi-phase alternating current power source. Furthermore, creating a ring like arc with 3n electrodes and 3 phase AC ($n \geq 2$) or with 2n electrodes and 2 phase AC or 8 electrodes and 4 phase AC are common in the art. For example, Richards teaches an example for melting glass using nine electrodes in a ring-like configuration with applying 3-phase current to the electrodes (col. 13 lines 40-48). Also, Koontz teaches melting glass with eight electrodes arranged in a ring-like configuration (col. 4 lines 55-57). Koontz also mentions using different currents of differing phases to accommodate the particular number of electrodes (col. 2 lines 16-20). Also, Machlan teaches using four-phase current to four electrodes used for melting glass (col. 3 lines 62-63, col. 4 lines 6-7, 13-15). Machlan also teaches the design configuration can be adapted to 2 phase power source or other multi-phase power source (col. 7 lines 40-45). It would have been obvious to one of ordinary skill in the art at the time the invention was made to have selected and optimized the desired number of electrodes with an appropriate multi-phase current power source, such as 3n electrodes with 3 phase AC or 2n electrode with 2 phase AC or 4 phase AC, for the heating purposes of the crucible in the method of Honma as the prior art has demonstrated that it is known to optimize these result effective variables through routine experimentation in order to achieve the predictable result of achieving the desired zone control over temperatures depending on the shape and size of the area to be heated.

9. Claim 13 and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Watanabe et al. (JP Abstract 02-188489) in view of Chenoweth (6,044,667), Sato (JP

56-31188) and Richards (5,364,426). Watanabe et al. disclose a process for pulling up a single crystal silicon and regenerating a quartz glass crucible by grinding foreign substance on an inside surface of the crucible and fusing the inside surface of the crucible to be smoothed with an arc discharge generated by an electrode (abstract). However, Watanabe et al. does not disclose specifics of the electrode used. Chenoweth teach the use of several electrodes positioned around a rotational axis, in which the neighboring electrodes are positioned at regular intervals from each other in a ring-like configuration forming a stable ring-like arc between the neighboring electrodes (Figure 1A col. 4 lines 45-48). Furthermore, Chenoweth shows in figure 3, a ring like arc between neighboring electrodes, without generating a continuous arc between electrodes facing each other across a central portion of the ring-like configuration. Chenoweth also teaches forming a circle with a radius that is about 1/3 of the radius of an open portion of the crucible with a diameter greater than 28 inches. Such an electrode arrangement allows for the controlled placement of the hot spot of the arc discharge within the crucible (col. 4 lines 48-50, col. 7 lines 23-25). It would have been obvious to one of ordinary skill in the art at the time the invention was made to utilize the electrode arrangement of Chenoweth in the process of Watanabe et al. in order to control a high temperature arc discharge to a large diameter crucible for even heating.

10. Regarding the electrode structure, Watanabe does not specifically recite an electrode structure with 3n electrodes with 3 phase AC. Chenoweth teaches using more or less electrodes in other configurations (col. 9 lines 19-20) and that other electrode configurations is an result effective variable that one skill in the art could arrive

at by routine experimentations (col. 10 lines 15-21). Sato teaches creating ring like arc with multiple electrodes with multi-phase alternating current power source. Furthermore, creating a ring like arc with 3n electrodes and 3 phase AC ($n \geq 2$) are common in the art. For example, Richards teaches an example for melting glass using nine electrodes in a ring-like configuration with applying 3-phase current to the electrodes (col. 13 lines 40-48). It would have been obvious to one of ordinary skill in the art at the time the invention was made to have selected and optimized the desired number of electrodes with an appropriate multi-phase current power source, such as 3n electrodes with 3 phase AC, for the heating purposes of the crucible in the method of Watanabe as the prior art has demonstrated that it is known to optimize these result effective variables through routine experimentation in order to achieve the predictable result of achieving the desired zone control over temperatures depending on the shape and size of the area to be heated.

11. Claims 4, 6, 9, and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Honma et al. (JP Abstract 2001-002430) in view of Chenoweth (6,044,667), Sato (JP 56-31188), Richards (5,364,426), Koontz (3,997,316), and Machlan (3,806,621)., as applied to claims 1 and 2 above, and in further view of Ohama et al. (6,886,364). Honma et al. do not mention the size of the crucible used for producing silicon single crystals. Although the melting vessel of Chenoweth is greater than 28 inches, it is not less than 40 inches. Ohama et al. teach fusing the inner surface of a quartz glass crucible with a diameter of 30 inches using arc discharge (col. 8 line 33). Such a crucible is used for the production of silicon single crystals, similarly to

Honma. It would have been obvious to one of ordinary skill in the art at the time the invention was made to utilize the crucible size of Ohama et al. as it has been demonstrated to be an effective crucible size for producing silicon single crystals at improved yields.

12. Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Watanabe et al. (JP Abstract 02-188489) in view of Chenoweth (6,044,667), Sato (JP 56-31188), and Richards (5,364,426), as applied to claim 13 above, and in further view of Ohama et al. (6,886,364). Watanabe et al. do not mention the size of the crucible used for producing silicon single crystals. Although the melting vessel of Chenoweth is greater than 28 inches, it is not less than 40 inches. Ohama et al. teach fusing the inner surface of a quartz glass crucible with a diameter of 30 inches using arc discharge (col. 8 line 33). Such a crucible is used for the production of silicon single crystals, similarly to Watanabe. It would have been obvious to one of ordinary skill in the art at the time the invention was made to utilize the crucible size of Ohama et al. as it has been demonstrated to be an effective crucible size for producing silicon single crystals at improved yields.

13. Claim 20 is rejected under 35 U.S.C. 103(a) as being unpatentable over Honma et al. (JP Abstract 2001-002430) in view of Chenoweth (6,044,667), Sato (JP 56-31188), Richards (5,364,426), Koontz (3,997,316), and Machlan (3,806,621)., as applied to claim 1 above, and in further view of Baker et al. (3,422,206). Chenoweth teaches an electrode arrangement that forms a circle with a radius that is about 1/3 of the radius of an open portion, but does not teach other embodiments. Baker teaches a

similar device as Chenoweth wherein the an electrode structure having 3 electrodes with a 3 phase AC power source positioned in a ring like configuration such that the radius of the ring-like configuration is greater than half of the open portion of the container (figures 1-3, col. 3 lines 29-50). According to the figures, it appears the radius of the ring-like configuration is about slightly less than the radius of the open portion. Baker also teaches that variations to the placement, number of electrodes and power source can also produce successful results. It would have been obvious to one of ordinary skill in the art at the time of the invention to have alternatively arranged the electrode structure of Chenoweth within the apparatus of Honma to have a ring-like configuration with a radius of at least half the open potion of the crucible as Baker has demonstrated such an embodiment is successful in providing the desired arc discharge and heat distribution required for heating glass. Furthermore, it would have been obvious to select and optimize the placement of the electrode structure and hence the radius of the ring configuration to achieve the desired heating effect.

Double Patenting

14. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory obviousness-type double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated

by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement.

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

15. Claim 1 is provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1 and 6 of copending Application No. 12/564,197 in view of Ohama et al. (6,886,364) and Richards (5,364,426). Claim 1 of the pending application '350 and claims 1 and 6 of copending application '197 both recite a similar method for fusing a silica crucible using an electrode structure in a ring shape configuration and forming a ring shape arc between neighboring electrodes while not generating an arc between oppositely facing electrodes, wherein the ring shape configuration has a radius of at least 1/4 the radius of the open portion of the crucible.

However, the copending application fails to teach of a crucible with a diameter of at least 28 inches. Ohama et al. teach fusing the inner surface of a quartz glass crucible with a diameter of 30 inches using arc discharge (col. 8 line 33). Such a crucible is used for the production of silicon single crystals, similarly to the copending application '197. It would have been obvious to one of ordinary skill in the art at the time the invention was made to utilize the crucible size of Ohama et al. as it has been demonstrated to be an effective crucible size for producing silicon single crystals at improved yields. Furthermore, the copending application '197 fails teach an electrode structure configuration comprising 3n electrodes with a 3 phase alternating current. However, such an electrode configuration is known in the art for heating and fusing glass. Richards teaches several electrode configurations varying in the number of electrodes as well as the number of phase of the AC source, including nine electrodes in a ring-like configuration with a 3-phase current to the electrodes (col. 13 lines 40-48). Richards teaches selecting the number of electrodes and the ac source to accommodate a proper fit to size of the container. It would have been obvious to one of ordinary skill in the art at the time of the invention to have utilized the electrode configuration in the method of the copending application as it has been demonstrated to be a suitable means for successful heating and melting of glass.3

16. This is a provisional obviousness-type double patenting rejection.

Response to Arguments

17. Applicant's arguments filed January 13, 2010 have been fully considered but they are not persuasive. The applicant argues Chenoweth fails to disclose a stable ring like

arc without generating a continuous arc between electrodes facing each other across a central portion of the ring like configuration. Applicant's arguments fail to comply with 37 CFR 1.111(b) because they amount to a general allegation that the claims define a patentable invention without specifically pointing out how the language of the claims patentably distinguishes them from the references. As pointed out in the previous rejection, the path of the heating current is illustrated in figure 3, which shows that no continuous arc is generated between oppositely facing electrodes across the center of the ring like configuration. Furthermore, the applicants contradicts himself in the argument as duplicated herein:

> *"Applicants respectfully submit that the '667 patent fails to disclose that a radius of the ring-like configuration around the rotational axis is at least ¼ of a radius R of an open portion of the crucible, but not greater than R, as recited in amended Claim 1. In this regard, Applicants note that the '667 patent discloses that the radius R_1 shown in Figure 1A is 1/4 - 1/3 of the radius R_2."*

18. As recognize by the applicant, Chenoweth does disclose a radius that is at least ¼ the radius of the open portion.

19. The applicant further argues the electrodes of Chenoweth are immersed in glass for heating the fused glass. Although the electrodes of Chenoweth are adapted for a slightly different embodiment, Chenoweth still teaches the use of such an electrode arrangement to provide for a ring like configuration of the arc discharge suitable for a container that is round for the even heating of glass in the container. Such an electrode arrangement is considered obvious considering the round shape of the crucible as well as the similar method of fusing glass, although a lesser quantity of glass.

20. In response to applicant's argument that the examiner's conclusion of obviousness is based upon improper hindsight reasoning, it must be recognized that

any judgment on obviousness is in a sense necessarily a reconstruction based upon hindsight reasoning. But so long as it takes into account only knowledge which was within the level of ordinary skill at the time the claimed invention was made, and does not include knowledge gleaned only from the applicant's disclosure, such a reconstruction is proper. See *In re McLaughlin*, 443 F.2d 1392, 170 USPQ 209 (CCPA 1971). As pointed out in the rejection, the prior art does teach to optimize the number of electrodes with the desired phase power source depending on the size and shape of the area to be heated. One skilled in the art would understand the heating range of a ring like configuration formed by 3 electrodes would be smaller in diameter than the heating range of a ring like configuration formed by 9 electrodes. So by utilizing a larger crucible size of greater than 28 inches, it would be obvious to adapt to the larger size by optimizing (in this case increasing) the number of electrodes used.

21. Applicant's arguments with respect to the remaining arguments have been considered but are moot in view of the new ground(s) of rejection.

22. Furthermore, a double patenting rejection is newly presented. This rejection was made based on a search necessitated by the applicant's new claim 20. This reference was not available prior to the previous office action dated July 13, 2009, and therefore could not be previous presented, since the filing date for the copending application is September 30, 2009.

Conclusion

23. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP

§ 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to QUEENIE DEHGHAN whose telephone number is (571)272-8209. The examiner can normally be reached on Monday through Friday 9:00am - 5:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Steven Griffin can be reached on 571-272-1189. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/Queenie Dehghan/

Examiner, Art Unit 1791